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Proposed DME

PEDIATRIC ASTHMA & BRONCHIOLITIS
Objectives

- Discuss and understand the current AAP diagnosis and management guidelines for bronchiolitis as they pertain to the Emergency Department.
- Discuss and understand the benefit of bronchodilator dexamethasone treatment in a certain subset of bronchiolitis patients.
- Discuss and understand the current treatment recommendations for pediatric asthma in the ED as well as the discharge treatment when appropriate.
- Discuss and understand the benefit of dexamethasone over other steroid preparations for asthma treatment.
Differential Diagnosis of Wheezing

- Asthma
- Bronchiolitis
- URI with wheezing
- Pneomothrax
- GERD with aspiration pneumonia
- Foreign body aspiration
- Pneumonia
- CHF

- Congenital pulmonary anomaly
- Cystic Fibrosis
- a1-Antitrypsin deficiency
- Tracheoesophageal fistula
- Allergic reaction/anaphylaxis
- Vocal cord dysfunction
- Toxic Exposure
CASE

- 3 mo female presents to the ED in January with 2 day history of cough and difficulty breathing. Hx of 100.1 temp.
- PMH neg with no perinatal concerns and immunizations UTD
- VS  HR 166, BP 92/56, RR72, O2 91 % Temp 100.4
Bronchiolitis: Epidemiology

- MC lower respiratory tract infection to affect infants and toddlers
- In the pediatric patient exclusively the result of a viral infection, MC RSV
- Hospital Costs $700 million annually: 132,000-172,000 hospitalizations ave 3-4 days
- Significant decrease in deaths to 500 annually secondary to immunization of high risk infants
- Still a high degree of morbidity.
- Risk factors for hospitalization: male sex, chronic illness, lower socioeconomic status, smoke exposure, and contact with other children.
Bronchiolitis: Pathogenesis

- Bronchiole obstructions with edema, cellular debris (epithelial and inflammatory cells), hyperplastic lymphoid follicles, and mucous resulting in wheezing
- Degree of obstruction changes as these areas are cleared which accounts for the changing clinical picture.
Bronchiolitis: Clinical Features

- Self limited: 7-10 days (28)
- Ubiquitous
- Can be severe
- Typically preceded by a 1-3 day hx of URI symptoms, then followed by wheezing and symptoms of respiratory distress.
- Tachypnic, intercostal and subcostal retractions, expiratory wheezing, prolonged expiratory phase, coarse or fine crackles, hyperexpanded chest, hyperresonance, hypoxemia.
AAP Bronchiolitis Treatment Guidelines

- 2006 Published in Pediatrics
  - Evidence based
- Improvement in care
- Appropriate decreased resource utilization and costs
- Unfortunately poor adherence
Bronchiolitis: Hx

- Special consideration for information that allows you to risk stratify the patient
  - Immunodeficiency
    - Cystic fibrosis
    - BPD
    - Hemodynamically significant congenital heart disease
  - Neuromuscular disorders
  - Prematurity/Birth Weight
  - Age less than three months*
  - Hx of Apnea
  - Hydration status
Bronchiolitis: PE

- Sx of respiratory distress
  - Tachypnea
  - Nasal flaring
  - Retractions
  - Grunting
  - Respiratory rate > 60
- Presence of cyanosis
- Episodes of restlessness or lethargy
- Evidence for moderate or severe dehydration
High risk infants are at risk for apneic episodes, severe respiratory distress and respiratory failure.

- AAP Guideline 1b
- “Clinicians should assess risk factors for severe disease such as age less than 12 weeks, a history of prematurity, underlying cardiopulmonary disease, or immunodeficiency when making decisions about evaluation and management of children with bronchiolitis”
Bronchiolitis: Dx

- Diagnostic Laboratory and radiographic tests are not indicated...AT THE CORRECT TIME OF YEAR AND IN THE CORRECT AGE GROUP IT IS A CLINICAL DIAGNOSIS.

- AAP Guideline 1a
- “Clinicians should diagnosis bronchiolitis and assess disease severity on the basis of hx and pe. Clinicians should not routinely order laboratory and radiographic studies for the diagnosis.”
Bronchiolitis: Dx Special Consideration

- >1 month with fever
  - The risk for SBI is low except for UTI
- <1 month with fever
  - Same/similar risk for SBI as infants this age without bronchiolitis
  - Septic workup
Bronchiolitis: Dx Special Consideration

- Routine radiography not indicated
- May be useful when....
  - Hospitalized children do not improve as expected
  - Severity of disease
  - Another diagnosis likely
Routing testing for specific viral agents does not alter the management or outcome of the illness and is not needed.

Consider if admitting to reduce nosocomial transmission.
Bronchiolitis: Tx

- Symptomatic Treatment
  - Goal to maintain adequate oxygenation and hydration
  - Nasal suctioning beneficial—no benefit of deep suctioning
Bronchiolitis: Tx

- Bronchodilators: B2 agonists, epinephrine
  - Not routinely recommended
  - May be of benefit in a subset of patients
    - Hx of atopy or parent/sibling with asthma

- AAP Guideline 2a
  - “Bronchodilators should not be routinely used in the management of bronchiolitis.”

- AAP Guideline 2b
  - “A carefully monitored trial of a-adrenergic or b-adrenergic medications is an option....continue only if there is a documented clinical response to the trial use on an objective means of evaluation.”
Bronchiolitis: Tx

- Corticosteroids
  - Meta-analysis including 2596 children showed no benefits in hospital admission rates, LOS, clinical score after 12 hours, hospital revisit or readmission rates
- No benefit in admitted mechanically ventilated patients
- AAP Guideline #3
  - Corticosteroid medications should not be used routinely in the management of bronchiolitis.
- Alasari et al. Pediatrics Sept 2013
Bronchiolitis: Tx

- **Antibiotics**
  - Should NOT be routinely used
  - Use only when a coexisting bacterial infection is present and use antibiotic appropriate for that infection.

- **Antiviral**
  - Benefit in only select situations
  - Difficult to give, health risk to care givers, expensive
Bronchiolitis: Tx

- Heliox
  - Meta-analysis showed improved clinical scores at 1 hour but no sustained benefit

- Inhaled glucocorticoids
  - No benefit

- Surfactant
  - In intubated patients, may shorten duration of mechanical ventilation and ICU LOS
Bronchiolitis: Tx

- Chest Physiotherapy
  - No benefit

- Hypertonic Saline
  - 3%-5% safe and effective
  - Associated with decreased LOS for hospitalized patients and improved clinical scores
  - No proven benefit in the ED

- High Flow Nasal Cannula (HFNC)
  - Heated and humidified O2 delivered at 8L-40L
  - Results in decreased rates of intubation in ICU patients
  - Studies small but showing promise
Bronchiolitis: Tx

- Prophylaxis
  - Palivizumab-monoclonal antibody
  - Given monthly injections during RSV season (Nov-March in US)
  - Decreases hospitalizations in high risk children
Child with suspected RSV infection

Clinical diagnosis
- Peak RSV season?
- Born term without serious complications?
- Absence of cardiopulmonary or immune disease?
- Absence of significant respiratory distress, apnea, hypoxia, signs of dehydration?
- Child < 2 months

Child > 28 days

Full sepsis workup if febrile
- RSV PCR
- Consider CXR

RSV PCR
- Consider urine culture if febrile
- Consider blood culture if < 60 days
- Consider CXR

Improvement after supportive care initiated (e.g., suctioning, oxygen)?

Consider DC if:
- well hydrated
- no oxygen requirement
- good follow-up
- no respiratory distress
- no (risk of) apnea

Trial of bronchodilators (albuterol, racemic epinephrine)

Clinical improvement?

Continue bronchodilator therapy

Significant symptoms persist?

Admission to hospital if:
- dehydrated
- oxygen requirement
- poor follow-up
- respiratory distress
- (risk of) apnea

Consider other therapy (e.g., nebulized 3% saline, ribavirin) after discussion with specialist.
Asthma Update

- Epidemiology
  - 13% of all children in the US with 6.7 million experiencing active disease
  - 3.5 million have >1 exacerbation per year
  - 600,000 ED visits; highest % in children <4
  - Compatible history of recurrent episodes of cough, respiratory distress, and wheezing
  - Disproportionately affects minority children, those in urban areas, and those of lower socioeconomic status
Asthma Update

- **Pathophysiology**
  - Airway obstruction
  - Bronchial hyper-responsiveness
  - Airway inflammation
  - Increased mucous production
Asthma Update

- Determine the severity of the episode
  - National Asthma Education and Prevention Program (NAEPP) recommends using spirometry or peak expiratory flow rate (PEFR)
  - This may be impossible in young or severely ill children

- Subjective clinical scores have been validated for use in such cases
  - PASS- Pediatric asthma severity score
  - Modified pulmonary index
  - Pulmonary score
## Table 1
### Acute asthma severity assessment

<table>
<thead>
<tr>
<th>Key examination elements (pediatric asthma severity score)</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
<th>Respiratory Arrest Imminent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wheeze</strong></td>
<td>None or mild (0)</td>
<td>Moderate (1)</td>
<td>Severe (2)</td>
<td>Diminished due to poor air exchange</td>
</tr>
<tr>
<td>None or end of expiration only</td>
<td>Throughout expiration</td>
<td>Inspiratory/expiratory or absent due to poor air exchange</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Work of breathing</strong></td>
<td>None or mild (0)</td>
<td>Moderate (1)</td>
<td>Severe (2)</td>
<td>Tiring, inability to maintain work of breathing</td>
</tr>
<tr>
<td>Normal or minimal retraction</td>
<td>Intercostal retractions</td>
<td>Suprasternal retractions, abdominal breathing</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Prolonged expiration</strong></td>
<td>None or mild (0)</td>
<td>Moderate (1)</td>
<td>Severe (2)</td>
<td>Severely prolonged</td>
</tr>
<tr>
<td>Normal or minimally prolonged</td>
<td>Normal or minimally prolonged</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other examination elements</strong></td>
<td>Normal</td>
<td>Decreased at bases</td>
<td>Widespread decrease</td>
<td>Absent/minimal</td>
</tr>
<tr>
<td><strong>Breath Sounds/aeration</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
<td>With activity or agitation</td>
<td>While at rest</td>
<td>While at rest</td>
<td>For infants: stops feeding, sits upright</td>
</tr>
<tr>
<td>Breathlessness</td>
<td>For infants: soft or shorter cry, difficulty feeding, prefers sitting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Alertness</strong></td>
<td>Alert</td>
<td>May be agitated</td>
<td>Agitated</td>
<td>Drowsy, confused</td>
</tr>
<tr>
<td><strong>Talks in</strong></td>
<td>Sentences</td>
<td>Phrases</td>
<td>Words</td>
<td></td>
</tr>
<tr>
<td><strong>Measurements</strong></td>
<td>&gt;94%</td>
<td>Variable</td>
<td>Variable</td>
<td>Variable</td>
</tr>
<tr>
<td>Pulse oximetry</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEF (% of predicted by height)</td>
<td>≥70%</td>
<td>40%–69%</td>
<td>&lt;40%</td>
<td></td>
</tr>
</tbody>
</table>
Asthma Update

- **Standard Tx**
  - Short acting B-agonists
    - Albuterol or levoalbuterol
    - Bronchodilation or relaxation of the smooth muscle
    - Studies have found in mild to moderate asthma equivalency or favor of MDI with spacer over nebulizers due to shorter LOS and less tachycardia
    - In severe asthma nebulizers necessary
  - Continuous nebulized SABA
    - Recommended in severe exacerbations or poor response to back-to-back dosing
Asthma Update

- Standard Tx
  - Ipratropium Bromide
    - Associated with lower admission rates for children with severe exacerbations and may reduce LOS
    - Relieves cholinergic bronchomotor tone and decreases mucosal edema and secretions
    - Multidose protocols effective
    - NNT to prevent one admission 7 in severe group, 12 in intermediate
      - Cost effective
Asthma Update

- **Standard Tx**
  - **Corticosteroids**
    - Reduce airway inflammation
    - Effective in moderate to severe cases
    - Administer early for maximum benefit
    - Reduce hospitalization rates and relapse visits
    - Mild exacerbations should receive steroids if the patient has an incomplete response to inhaled SABA
    - Oral administration preferred
      - Consider dexamethasone- similar relapse rates with less vomiting
    - No benefit in the acute attack
<table>
<thead>
<tr>
<th></th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Albuterol</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delivery device</td>
<td>MDI with valved holding chamber</td>
<td>MDI with valved holding chamber or</td>
<td>Nebulizer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>nebulizer</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>Intermittent treatment every 20 min</td>
<td>Intermittent or continuous treatment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>up to 3 doses in 60 min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dosing</td>
<td>Weight (kg)</td>
<td>MDI</td>
<td>Nebulizer (intermittent)</td>
</tr>
<tr>
<td></td>
<td>&lt;5</td>
<td>2 Puffs</td>
<td>1.25 mg</td>
</tr>
<tr>
<td></td>
<td>5–10</td>
<td>4 Puffs</td>
<td>2.5 mg</td>
</tr>
<tr>
<td></td>
<td>10–20</td>
<td>6 Puffs</td>
<td>3.75 mg</td>
</tr>
<tr>
<td></td>
<td>&gt;20</td>
<td>8 Puffs</td>
<td>5 mg</td>
</tr>
<tr>
<td></td>
<td>(Mix with albuterol)</td>
<td></td>
<td>5 mg/h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10 mg/h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>15 mg/h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20 mg/h</td>
</tr>
<tr>
<td>Ipratropium bromide</td>
<td>(Mix with albuterol)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment</td>
<td>Not proved effective</td>
<td>Likely effective when added to</td>
<td>Effective, particularly multiple doses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>β-agonist</td>
<td></td>
</tr>
<tr>
<td>Delivery device</td>
<td>Weight (kg)</td>
<td>Nebulizer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;10</td>
<td>250 μg × 3 doses</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;10</td>
<td>500 μg × 2 doses</td>
<td></td>
</tr>
<tr>
<td>Systemic corticosteroids</td>
<td>Consider if incomplete response to initial therapy</td>
<td>Administer as early as possible for maximal benefit</td>
<td></td>
</tr>
<tr>
<td>Route</td>
<td>Oral</td>
<td>Oral route as effective as parenteral</td>
<td></td>
</tr>
<tr>
<td>Dose</td>
<td>Prednisone or prednisolone</td>
<td>Prednisone or prednisolone or methylprednisolone</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 mg/kg (max 60 mg)</td>
<td>2 mg/kg (max 60 mg)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: First-line medications for acute asthma by acute severity level.
Asthma Update

- Standard Tx
  - Reassess the patient
    - If incomplete or poor response further treat with SABA and consider admission
Asthma Update

- **Adjunctive Tx**
  - **Magnesium Sulfate**
    - Improved pulmonary function and reduced hospitalization rates
    - 50-75mg/kg IV Max 2 g
  - **Heliox-oxygen-delivered SABA 70:30 or 80:20**
    - May improve outcomes in severe exacerbations
Asthma Update

- Adjunctive Treatment
  - Systemic B-agonists
    - Epinephrine SQ or IM
    - Terbutaline SQ or IV
  - BIPAP
    - Well tolerated and may reduce need for ICU admission
    - Benefits patients tiring from increased work of breathing and impending respiratory failure
Asthma Update

- NAEPP guidelines recommend ED providers consider initiating controller medications to appropriate patients
  - Many patients don’t have or don’t utilize appropriate follow up
  - Some primary care clinicians are not following the guidelines with these patients
  - Briefly assess asthma control
### Asthma Classification


**Age ≥ 12 years – Adults**

<table>
<thead>
<tr>
<th>COMPONENTS OF SEVERITY</th>
<th>Classification of Asthma Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intermittent</td>
</tr>
<tr>
<td></td>
<td>Mild</td>
</tr>
<tr>
<td>Impairment</td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td>≤2 days/wk</td>
</tr>
<tr>
<td>Nighttime Awakenings</td>
<td>≤2x/month</td>
</tr>
<tr>
<td>SABA Use for Symptoms</td>
<td>≤2 days/wk not daily and not &gt;1/day</td>
</tr>
<tr>
<td>Interference with Normal Activity</td>
<td>None</td>
</tr>
<tr>
<td>Lung Function</td>
<td></td>
</tr>
<tr>
<td>FEV₁/FVC</td>
<td>Normal FEV₁, btw exacerbations</td>
</tr>
<tr>
<td>Risk</td>
<td></td>
</tr>
<tr>
<td>Exacerbations requiring oral steroids</td>
<td>0-1/year</td>
</tr>
<tr>
<td>Recommended Step for Initiating Treatment</td>
<td>Step 1</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Re-evaluate control in 2-6 weeks and adjust therapy accordingly.</td>
</tr>
</tbody>
</table>

### Treatment recommendation

**Step 1:** Short-acting beta agonist PRN

**Step 2:** Low-dose inhaled corticosteroid

**Step 3:** Low-dose inhaled corticosteroid + long-acting beta agonist, OR medium-dose inhaled corticosteroid

**Step 4:** Medium-dose inhaled corticosteroid + long-acting beta agonist

**Step 5:** High-dose inhaled corticosteroid + long-acting beta agonist AND consider omalizumab for patient with allergies
Asthma Update

- Communication
  - Direct communication with the parent about controller medications at home as well as with the child if age/development appropriate improves adherence, improving control, decreasing exacerbations and ED visits
Key Points: Bronchiolitis

- The diagnosis and management of routine bronchiolitis in the ED is made clinically and the treatment is supportive.

- RSV testing during season is only beneficial for nosocomial transmission concerns.

- In a subset of patients* a trial of bronchodilator is indicted with continuation and the addition of dexamethasone if responsive.
Key Points: Asthma

- Knowledge of the current asthma guidelines and understanding how to evaluate for severity of symptoms will improve your asthma care.

- Consider dexamethasone as your first line steroid.

- Consider magnesium and BIPAP for the severe asthmatic.

- Consider addressing home controller medication needs.
References

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